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J. Helminthol. Soc. Wash.
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***Research Note***

# *Sarcocystis* sp. (Apicomplexa) from the New Mexico Ridgenose Rattlesnake, *Crotalus willardi obscurus* (Serpentes: Viperidae) from Sonora, Mexico

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ABSTRACT: Two of 4 New Mexico ridgenose rattlesnakes, *Crotalus willardi obscurus* Harris, 1974, from Sonora, Mexico, were found to be passing oocysts and free sporocysts of a *Sarcocystis* sp. in their feces. Sporocysts measured 11.9 × 10.3 (11.0–13.6 × 9.6–11.2) μm ($N = 20$) and had a shape index (length/width) of 1.15 (1.07–1.23). Attempts to transmit the *Sarcocystis* sp. experimentally to *Mus musculus, Peromyscus leucopus,* or *Microtus ochrogaster* were unsuccessful. This represents the first report of a parasite from this host.

KEY WORDS: Apicomplexa, *Sarcocystis* sp., Reptilia, Serpentes, Viperidae, ridgenose rattlesnake, oocysts, sporocysts, survey.

The New Mexico ridgenose rattlesnake, *Crotalus willardi obscurus* Harris, 1974, is a medium-sized viperid that ranges from the Animas and Peloncillo Mountains of extreme southwestern New Mexico south into the Sierra Madre Occidental to Zacatecas, Mexico (Stebbins, 1985; Campbell, et al., 1989). It is chiefly a mountain-dwelling snake occurring in the pine-oak and pine-fir belts, but also inhabits foothill canyons of madrean habitat. Although Barker (1992) recently reported on various aspects of the biology of *C. willardi,* nothing, to our knowledge, has been published on parasites of this snake. Here, we provide the first report of a parasite from *C. willardi obscurus.*

As part of a long-term mark-recapture study, 4 *C. willardi obscurus* (1 male, 3 females; snout–vent length = 370–463 mm) were collected during March 1990 from an unnamed canyon north of Cañon El Diablo, Sierra San Luis, Sonora, Mexico (elev. 1,920 m). Feces were obtained and snakes were released unharmed at their original point of capture. Samples were placed in 2.5% (w/v) aqueous potassium dichromate and processed further for coccidia using previously described methods (Upton and McAllister, 1990). Measurements were made on 20 sporocysts using a calibrated ocular micrometer and are reported

as length × width means ± 1 SE followed by the ranges in parentheses. Samples were 14 days old when measured and photographed.

Following the protocol of McAllister et al. (1995) for experimental transmission studies, 500 sporocysts were inoculated into each rodent (1 *Mus musculus,* 1 *Peromyscus leucopus,* and 1 *Microtus ochrogaster*). At 91 days postinoculation, rodents were killed with ether, and portions of tongue, diaphragm, heart, and skeletal muscle tissues were examined for sarcocysts.

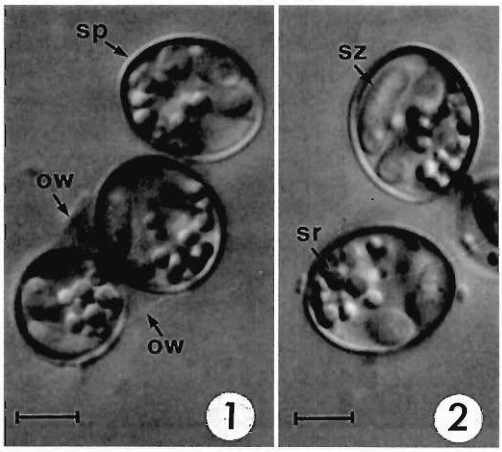
A voucher photo of *Sarcocystis* sp. is deposited in the U.S. National Parasite Collection, Beltsville, Maryland 20705, as USNPC 84752. A voucher photograph of *C. willardi obscurus* is deposited in the Arkansas State University Museum of Zoology as ASUMZ 20161.

Oocysts and free sporocysts of a *Sarcocystis* sp. (Figs. 1, 2) were found in feces of 2 of the snakes. Measurements on 20 sporocysts were 11.9 ± 0.2 × 10.3 ± 0.1 (11.0–13.6 × 9.6–11.2) μm and had a shape index (width/length) of 1.15 ± 0.01 (1.07–1.23). These length and width measurements were most similar to those reported for sporocysts of a *Sarcocystis* sp. (isolate SAR-26) from western diamondback rattlesnakes, *Crotalus atrox,* from Texas (McAllister et al., 1995).

All 3 species of rodents inoculated with sporocysts of *Sarcocystis* sp. were negative for detectable sarcocysts in tissues. Similarly, attempts to infect the same potential rodent intermediate hosts experimentally with several isolates of *Sarcocystis* spp. from *C. atrox* have been unsuccessful (McAllister et al., 1995), and strongly suggest that other species of rodents are involved in the life cycle.

Various species of *Sarcocystis* have been reported from snakes worldwide (Dubey et al., 1989). In North America, viperids previously reported to harbor *Sarcocystis* spp. include *Crotalus adamanteus, C. atrox, C. horridus, C. scutulatus, C. viridis, Agkistrodon contortrix, A. piscivorous leucostoma, Sistrurus catenatus,* and *S. miliarius streckeri* (see Upton and McAllister, 1990; Upton et al., 1992; McAllister et al., 1995). Although measurements of various isolates of *Sarcocystis* sp. suggest that multiple species exist in *C. atrox* and possibly in other viperids (McAllister et al., 1995), tissue stages recovered in the intermediate host are necessary for species identification.

In conclusion, we have provided the first report of an apicomplexan parasite from *C. willardi obscurus.* We suggest that additional snakes be surveyed to obtain sporocysts for further experimental transmission studies in alternate species of rodent intermediate hosts.




**Figures 1, 2. Nomarski interference-contrast photomicrographs of oocysts and free sporocysts of *Sarcocystis* sp. from feces of *Crotalus willardi obscurus* from Sonora, Mexico. 1. View of oocyst containing 2 sporocysts and separate free sporocyst. 2. Free sporocysts. Abbreviations: ow = oocyst wall, sp = sporocyst, sr = sporocyst residuum, sz = sporozoite. Scale bars = 5.0 μm.**

We thank our Mexican cooperator, David Lazcano, Museo de Historia Natural and Universidad Autonoma de Nuevo Leon, for providing samples, and Dr. B. Raphael, Bronx Zoo, and C. Garrett, Dallas Zoo, for technical assistance. The New Mexico Department of Game and Fish is gratefully acknowledged for financial support through Professional Services Contract no. 5-516.6-76-16.

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J. Helminthol. Soc. Wash.
63(1), 1996, pp. 130–135

***Research Note***

# Host-Induced and Geographical Variation in *Levinseniella cruzi* Travassos, 1920 (Digenea: Microphallidae)

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ABSTRACT: Morphological variation in *Levinseniella cruzi* (Digenea: Microphallidae) among the hosts from 3 localities, *Rollandia rolland chilensis* (Podicipedidae), *Himantopus melanurus* (Recurvirostridae), and *Vanellus chilensis lampronotus* (Charadriidae), was analyzed through an ANOVA test and with cluster analysis. A great variation in body shape and size of parasites is noted. Male pocket length and number, sucker diameter, pharynx and genital papillae length, and ratio of suckers appear to be the most constant features and, therefore, valuable for systematic purposes. The morphological variation is discussed in relation to host species and geographical distribution. A new host for *L. cruzi* is reported.

KEY WORDS: Digenea, Microphallidae, Aquatic birds, host-induced variations.

*Levinseniella cruzi* was previously reported by Martorelli (1988) from the ceca of 2 birds from Buenos Aires Province: the white tufted grebe, *Rollandia rolland chilensis* Lesson, 1828 (Podicipedidae) and the South American stilt, *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae). We analyzed the morphological variation of *L. cruzi* among avian hosts from various geographic localities.

Definitive hosts were collected from 3 localities related with lentic freshwater environments in Buenos Aires Province (Argentine): Chascomús, a typical "pampa lagoon" which drains in Río Salado system (35°36′S, 58°00′W); Mar Chiquita, a large lagoon by the sea in contact with the Atlantic Ocean (37°46′S, 57°27′W) and Los Talas, artificial and small lagoons related to the Río de La Plata system (34°52′S, 57°00′W).

Six specimens of each species of bird included in this study were examined: *R. r. chilensis* from Los Talas, *R. r. chilensis* from Chascomús, and *H. melanurus* and *Vanellus chilensis lampronotus* Wagler, 1827 (Charadriidae) from Mar Chiquita.

Voucher specimens of this parasite from different hosts and localities were deposited in the Museo de la Plata, La Plata, Buenos Aires, Argentina, Helminth Coll. no. 3303 a, b; 3304 a, b, c; 3305 a, b, and in USNPC 84905–84908.

All the digeneans measured were recovered alive from the bird's cecum, fixed in Bouin Hollande pressured with a cover glass, stained in Langeron alcoholic carmine, dehydrated in ethanol, cleared in creosote, and mounted in natural Canada balsam. All dimensions were given in millimeters. The morphological variation was studied taking into consideration the measurements shown in Table 1.

One-way analysis of variance (ANOVA) and Tukey's multiple range test were used to appraise differences in these morphological dimensions among 3 groups of specimens: 1) parasites from *R. r. chilensis,* 2) parasites from *H. melanurus,* and 3) parasites from *V. ch. lampronotus* (referred to as groups 1, 2, and 3 hereafter).

Moreover, in order to compare the specimens of *L. cruzi* from different hosts and their localities